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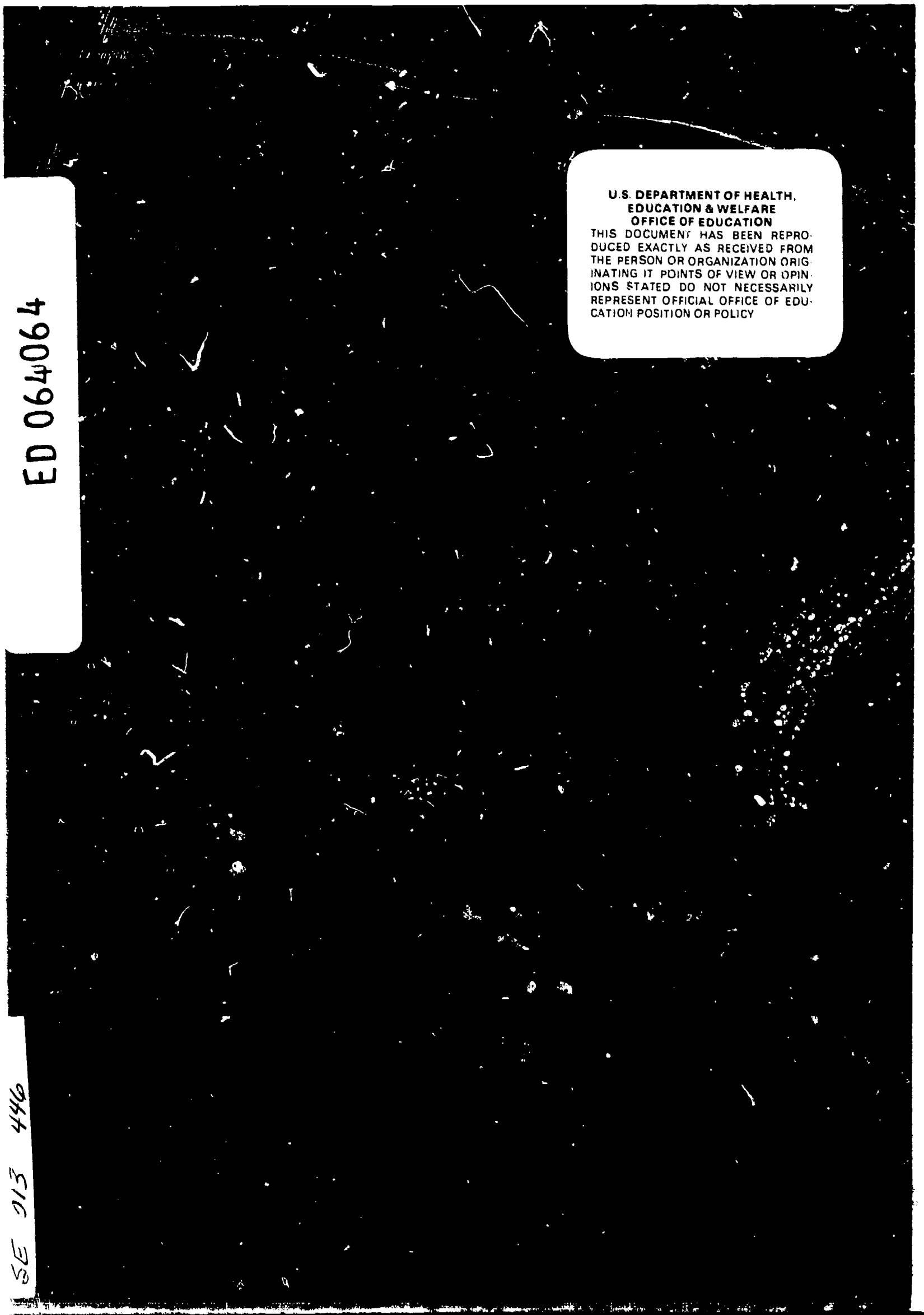
ABSTRACT

This address to the Paleontological Society considers the present status of paleontology and tries to predict what will be needed in the coming decade for continued professional growth. The first of the three parts of this discussion is a characterization of paleontologists, the second is a review of how paleontologists view their tasks and training, and the third is a proposal for action which could justify support of paleontologists. Data from the Council on Education in the Geological Sciences (CEGS) publication, "Requirements in the Field of Geology" (SE 009 054 - ED 044 272), are extensively utilized in this report. (Author/PR)



# PRESIDENTIAL ADDRESS:

# PALEONTOLOGISTS AND PALEONTOLOGY—AN APPRAISAL AND A PROPOSAL[1]

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THE opportunity of selecting a suitable topic for an address coincides with the start of my fourth paleontological decade and also with the beginning of what is being called the "environmental decade." For the past year I have tried to be especially attentive and reflective concerning the quality and prospects of paleontologists and paleontology. It is also natural for those of us who are teachers to contemplate the probable success of the students we train. The purposes of this paper, therefore, are to consider the present status of paleontology and to try to predict what will be needed in the coming decade for continued professional growth. The subject will be divided into three parts. The first will be a characterization of paleontologists, the second will be a review of how paleontologists conceive of their tasks and training, and the third will be a proposal for action which you may feel will justify your support.

Let us start by looking at ourselves as a profession in this country. The Joint Committee on Paleontologic Information recently has identified about 2,500 professional paleontologists in North America. Efforts are under way to try to ascertain the number of amateur paleontologists, but that is an almost impossible task. It is likely that there are many more amateurs than professionals. The point is that we constitute a very small population of semi-organized scientists. Moreover, we usually comprise a minority group on the faculties of the academic departments or staffs of other institutions. It is fortunate for us that our closest colleagues are enlightened enough to recognize value in our presence, otherwise we might be relegated to an even more minor position than we now occupy.

Additional information about us is presented in a study by the Council on Education in the Geological Sciences (CEGS) which is sponsored by the American Geological Institute. I refer you to their publication number 5, entitled "Requirements in the Field of Geology," (1970). According to that source, fully half (50.3%) of the paleontologists in the United States have accumulated fewer than ten years experience in the profession and more than a quarter of them (26.9%) have four years or less experience. Thus paleontologists together with oceanographers and geochemists encompass a rather distinctly young group as compared with the remaining branches of earth scientists. Moreover, paleontologists share with the oceanographers and geochemists the distinction of being the three smallest recognized professional entities numerically in the CEGS report.

Finally, amongst all earth scientists, only the geochemists slightly exceed the paleontologists in the extent of their education as judged by the number of persons holding a Ph.D. degree. Half of the members of each of these two groups have been granted Ph.D. degrees. Contrariwise, most members of other geological branches tend to terminate their formal education short of this goal; somewhat less than 20% of them have Ph.D. degrees, except for the oceanographers, of whom about 28% achieve Ph.D. degrees.

Additional educational statistics have been furnished by Bonnie Henderson of the AGI office. She separated data for paleontologists from that included with geologists by the Com-

[1] Contribution 234 from the Department of Geological Sciences, University of Southern California.

mittee on Manpower in connection with their 1970 report entitled "Manpower Supply and Demand in Earth Science, 1969–1974." Using sampling techniques, she estimated that 203 paleontologists hold the Bachelor's degree, 403 hold the Master's degree, and 521 hold the Ph.D. Although paleontologists only comprise 4.4% of the geologists in the National Register, we hold over 12% of the Ph.D. degrees.

What, then, are paleontologists? Statistically, they constitute a tiny group with an unusually large number of young persons who either must be overly bright or especially dogged in pursing their education. And they seem to share these characteristics with two other groups of earth scientists whose fields currently are believed to offer unusually attractive prospects for innovative work and rewarding professional lives. At this point it would seem to be appropriate, in the presence of this erudite gathering, to inject something obscure, so I greet you with a modification of the select Roman salutation and cry, "*Salve, senatus populusque paleontologicus!*"

It is to be hoped that these revelations will enrich your days, confuse your critics, and enshroud you with the admiration of friends and family. And if some of us feel vaguely uncomfortable to be found in professional company such as this, let us be gratified that the statistics provide a shield for either our inadequacies or our alienation.

While this professional profile is being developed, I think that you will be interested in some additional statistics furnished by the AGI office. Currently 1,127 paleontologists are employed full time, of which about 50% of us are engaged in academic pursuits, 25% are employed by industry, 8% are in governmental employ, and the rest are self-employed, or in military, or in nonprofit institutions. If the Committee on Manpower reads the future correctly, then the employment of Bachelor's degree holders will drop over the next four years, Master's will remain the same, and Ph.D.'s will increase. All told, the Committee on Manpower estimates that about 60 new paleontologists will be needed this year and yearly thereafter through 1974, of whom about 37 each year will have earned a Ph.D. degree.

Now all this education presumably reflects increased sophistication in our profession. If it sometimes does not, and only represents more complicated ways of obtaining the same results, then we are like the two men in a prison. One cellmate who was ambitious said to the complacent one, "I am going to spend my time studying and improving myself, and although you will remain a common thief, I will become an embezzler."

Seriously, however, we surely would agree that the breadth of interests held by paleontologists has been increasing rapidly, and that the potential for creative work in paleontology is accelerating. It appears that paleontologists believe that our science is entering an era of much increased quantification and interdisciplinary activities. A perusal of the literature indicates that many young paleontologists who have entered the profession in the last ten years have combined their interest in fossils with correlative interests in ecology, mathematics, geochemistry, crystallography, sedimentology, oceanography, and spatial stratigraphy. Moreover, many older paleontologists have shifted their approaches and retrained themselves to accommodate their interests to the new trends. This is most definitely not to imply that these novel interests have supplanted what are sometimes considered to be classical studies. After all, the bases of all paleontologic research must rest to some extent (and usually primarily) upon paleontologists who dedicate their talents towards explicating morphology, evolution, classification, descriptions, and zonal and geographic distribution. The two obvious points are that one cannot be quantitative without having something to quantify, and that basic paleontologic concepts need to be augmented by linkage with other disciplines. It seems to me that the proper posture for the profession at this time is that we should encourage every professional attitude that will improve the effectiveness and utilization of paleontology. Moreover, it would seem to be obvious that some balance ought to be maintained in the training of paleontologists so that we can communicate with each other and with other scientists. And finally, it would seem to be desirable that a proper background of insights be provided in curricula so that it is possible to work creatively and critically within our fields.

Now it happens that these admittedly platitudinous conclusions can be evaluated in so far as they apply to today's practicing paleontologists by referring again to the CEGS report mentioned above. The committee that prepared the report circulated a questionnaire among specialists in 15 branches of the earth sciences. Respondents ranked 200 concepts, disciplines, and techniques listed as items. The items first were ranked as to their usefulness to the person, and second as to his estimate of his own competence in handling the various items. Responses from paleontologists indicate that the ten most useful

items in descending order of importance are those listed below:

| | |
|---|---|
| 1. Principles of evolution | 244 |
| 2. Principles of ecology | 257 |
| 3. Interpretation of sedimentary environments | 249 |
| 4. Paleoenvirorments | 263 |
| 5. Library research and reference materials | 4 |
| 6. Geologic time scale | 3 |
| 7. Stratigraphic paleontology | 96 |
| 8. Biogeography | 274 |
| 9. Technical writing | 215 |
| 10. Description and classification of macrofossils | 100 |

Several points merit comment. First, the paleontologists listed major fields such as evolution, ecology, paleoenvironments, stratigraphic paleontology, and biogeography as being useful, but did not list the items which are necessary for the understanding of these major fields. Thus, description and classification of any kind of fossils barely made the list of the top ten items, yet it is not possible for a paleontologist to do much work in any of the items which were listed, unless he uses first some skill in identification. Second, none of the basic sciences or mathematics is listed in the top ten, yet we hear much today about quantification and interdisciplinary studies. But the third and most astonishing aspect of the table is to be noted in the right hand column of figures. They show the numerical value of the rank of competence which respondents believe that they have attained in each of the useful items listed among the 290 choices. The smallest numbers indicate the greatest competency, so you will note that near perfection is to be found only in the use of the geologic time scale and in library research and reference materials. Curiously, stratigraphic paleontology and description and classification of macrofossils, both of which are deprecated in some quarters as being old hat and relics of the classical era of prequantitative paleontology, receive scores of 96 and 100 respectively, indicating that paleontologists consider themselves to be only about two-thirds as competent in these supposedly elementary items as they might be. As for the remaining six items, they all rank far down the list in rank of competence—mostly within the lowest 15%. As a teacher of evolution, I was dismayed to learn that our top-ranked item in terms of usefulness rates 244 in order of competence. If this tabulation is truly representative of abilities within our profession, then our editors well may wonder about the qualifications of contributors in these fields of generally low competence and about the ability of the membership to comprehend published articles on the subjects.

However, the CEGS report lists many other items among the top 50, so continued tabulation reconciles some omissions and inconsistencies. Thus, farther down the list we find these additional items which reflect a distinctly biological aspect:

| | |
|---|---|
| 11. Description and classification of microfossils | 219 |
| 13. Functional morphology | 276 |
| 17. Population genetics | 283 |
| 21. Population dynamics | 288 |
| 26. Biometrical techniques | 287 |
| 29. Organic sedimentary processes | 271 |
| 33. Comparative anatomy | 269 |
| 34. Principles of paleobotany | 278 |
| 41. Description and classification of plant fossils | 282 |

From this sequence we apparently learn that studies of genetics, populations, and comparative anatomy, all of which are absolutely indispensable for professional comprehension of evolution (which was our top-ranked item in the previous table), are all noted to be less useful than is knowledge of the philosophy which they explain! And if that seems to be inconsistent and confusing, then examine the right hand column from which we learn that competence in these several cornerstones of evolutionary theory is less than in the evolutionary discipline (ranking 244) which is synthesized from them! The only outstanding consistency in the list is that paleontologists seem to judge themselves to be abysmally incompetent in all of the fields of the second list, no matter how useful the items are rated. When ratings are translated into the customary scholastic grades, they indicate a range of competence from 1% to a high of 7½ %.

Among the top 50 items, the following have a distinctly *quantified* flavor:

| | |
|---|---|
| 18. Graphical data representation | 139 |
| 24. Graphic techniques in stratigraphy | 226 |
| 35. Sampling design and procedures | 258 |
| 36. Sedimentary facies models | 251 |
| 37. Isopach and facies maps | 136 |
| 39. Computer programming | 290 |
| 43. Analysis of variables in stratigraphy | 286 |
| 47. Geochronology | 252 |

It is a strange fact that paleontologists score themselves slightly higher for competence in most of these items of physical nature than they do in the previous list of biologically-centered iems. But even so, the scores are very low—the highest being only equivalent to a grade of 47%. It should also be noted that the items tend toward being graphical techniques and methods, whereas you would discover in several other branches of the earth sciences that specific mathematical skills were cited.

TABLE 1—Usefulness of paleontology to other earth scientists.

| | Geochemists | Geohydrologists | Crystallographers | Metamorphic petrologists | Astrogeologists | Economic geologists | Engineering geologists | Geophysicists | Geomorphologists | Structural geologists | Oceanographers | Petroleum geologists | Sedimentologists | Stratigraphers | Paleontologists | All respondents |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Geologic time scale | | | | | 19 | 37 | 49 | 21 | 18 | 18 | 14 | 21 | 14 | 10 | 6 | 6 |
| Sedimentary environments | | | | | | | | | 24 | 35 | 23 | 9 | 1 | | 16 | |
| Principles of ecology | | | | | | | | | 40 | | 35 | | 32 | 35 | 2 | |
| Organic sedimentary processes | | | | | | | | | | | 36 | 43 | 33 | 34 | 29 | |
| Paleoenvironments | | | | | | | | | | | 41 | 18 | 16 | 8 | 4 | 44 |
| Interpretation of sedimentary environments | | | | | | | | | | 36 | | | 3 | 1 | 3 | |
| Stratigraphic paleontology | | | | | | | | | | | | 39 | | 32 | 7 | |
| Description and classification of macrofossils | | | | | | | | | | | | | | 39 | 10 | |
| Description and classification of microfossils | | | | | | | | | | | | | | 44 | 11 | |

So far this has been a very negative presentation, so it is appropriate now to list the fields in which paleontologists consider themselves to be well trained. The top 5 of the 50 listed with their actual numerical order are as follows:

3. Geologic time scale
4. Library research and reference materials
8. Map interpretation methods
23. Geologic field mapping methods
32. Sedimentary rock classification systems

It is immediately apparent that these five items are not strictly biological, much less paleontological; nor are they particularly quantified; nor are they in the vanguard of current interdisciplinary studies; nor do they reflect the presumed sophistication of postgraduate studies. I think that it is safe to say that if one of us had been asked to identify the branch of earth science characterized by these items, it is quite probable that about the last group to be seized upon would have been paleontology.

So far I have only been presenting data on how we paleontologists view ourselves. Now let us take a brief look in Table 1 at how other earth scientists rank the usefulness of paleontology as an adjunct to their own specialties.

Geochemists, geohydrologists, crystallographers, astrogeologists, economic geologists, engineering geologists, geophysicists, and metamorphic petrologists do not cite any paleontologic item among the top 50 of their most useful items. It is entirely understandable that several of our brother earth scientists judge our contributions to be inapplicable in their work, but it is a little surprising to me to find that economic geologists are in the above list. Apparently the search for fossil fuels, ores, and nonmetallics in the sedimentary record now goes on without much dependance upon paleontology.

To continue the analysis, geomorphologists find the geologic time scale, sedimentary environments, and principles of ecology to be useful. The last item might be included as much because of its relevance to modern life zones as to paleoecology. In any case it is hard to imagine how sedimentary environments and ecologic zones can be recognized without other paleontological skills not specified by the geomorphologists.

A revelation of the CEGS report very surprising to me is the lack of usefulness which structural geologists assign to paleontological

factors. This may reflect the interests of many structural geologists in igneous and metamorphic terrains. But, I still cannot understand how the environmental items which were listed can be recognized in the absence of more basic paleontologic items. The choices of the structural geologists would seem to indicate that they are interested in the depositional regimens attendant upon diastrophism, and not in the use of paleontology as a tool for unravelling structural complications in sedimentary rocks.

You are no doubt relieved to note our improved acceptance by the oceanographers, petroleum geologists, and sedimentologists. They all consider about the same items to be useful, but one observes the same apparent inconsistencies in their choices that exist in the relative rank we assign to some of our own. Namely, there is stronger interest in environmental factors than there is in having the ability to evaluate and to think critically about these items. This is also an especially pertinent point with regard to the listing of stratigraphic paleontology by petroleum geologists, for they omit all reference to the macrofossils and microfossils used in stratigraphic paleontology.

The final branch, the stratigraphers, are most like the paleontologists in their choice of useful items, and this was to be expected. In fact, paleontologists and stratigraphers commonly listed themselves dually in the questionnaire. Incidentally, the stratigraphers are fairly consistent about ranking usefulness in balance with their basic training and competence.

The summary column showing the ranking of items by all respondents probably is not very meaningful, considering the diversity of the earth sciences. Yet it is interesting that the only manifestly paleontologic item is paleoenvironments.

Well, what, then, can be concluded from the foregoing tabular data?

First of all, it is apparent that appropriate branches of the earth sciences are inclined to participate in the popular thrust toward increased emphasis upon environmental or ecologic aspects of their work. On the other hand, it seems that there is general disregard in the earth sciences of the tools by means of which environmental interpretations are made. Specifically, the basic disciplines in the life sciences, including paleontology, are ignored.

Second, it appears that paleontology is not as highly valued as it once was, even as an applied science in the petroleum industry. We are not doing a very good job of selling ourselves.

Third, the mathematical groundwork upon which the much-vaunted quantification of science is supposed to be based is notoriously absent from the list of paleontologically useful items.

Fourth, it would seem that there is a striking inconsistency between the usefulness of items and the competence of paleontologists to use them.

Fifth, paleontologists indicate that they are less competent in biological aspects of their profession than in physical aspects.

Sixth, the usefulness and competency with which some major discipline is viewed are not correlated with the usefulness and competency required in subordinate or preparatory fields necessary to work in the major discipline.

Seventh, and last, it would appear in summation that our oft-stated views of the directions in which the paleontological profession is heading are not supported by our own evaluation of our skills. The CEGS report indicates that our aspirations to enter a new age are in danger of not being realized. This is perhaps the major impact of the CEGS report.

Of course it can be argued that the data are insufficient to support the foregoing conclusions, and in fact there is a certain amount of justification to the charge. After all, only 1105 earth scientists responded to the CEGS questionnaire, and statistically only about 70 of the respondents were paleontologists. Thus, the distribution of the sample may not have been representative of the profession in any one way or combination of ways. Also, the rankings were placed in numerical sequence by statistical methods, whereas a person actually may consider himself to be equally well trained, in so far as he can judge, in several items. Lastly, it can be argued that a somewhat different selection of items would have been more illuminating in the questionaire.

Nevertheless, for the moment these data represent the broadest attempt so far undertaken to evaluate the profession of paleontology as viewed by paleontologists. Furthermore, we can draw upon our own experiences and on subjective and intuitive views to weigh the impact of the data.

For my part, I feel very hopeful and encouraged about the future of the profession, in spite of the problems raised by the report. It seems to me that there is a profound contradiction between the rather negative tabular data regarding competency, and the earlier report that paleontology is presently attracting a large number of young, energetic, and unusually bright people. The evidence in our meetings is that we are being flooded with speakers on a myriad of paleontological subjects. The paleontological jour-

nals are scarcely able to publish the flood of qualified manuscripts. New opportunities for significant paleontological research are emerging in physical fields such as geochemistry, geochronology, crystallography, ultramicroscopy, and paleomagnetism. And back in the oft-maligned classical areas we are witnessing major refinements in the taxonomy of most recognizable organisms, as well as trace fossils, and some problematica. There is vastly improved understanding of the stratigraphic utility of pollens, spores, and nannoplankton. We are now seeing vertebrate species as populations and are beginning to look in upon the origin of mammals with improved insight. The nature of the oldest forms of life is yielding to scrutiny from microscopic examination, geochemical analysis, and geochronological dating, so that we are on the threshold of discovering how and when the atmosphere evolved and how and when plants and animals began to create the biosphere. And if we are canny enough, we may even be able to reach back and touch with scientific confidence upon the origin of life itself.

Never have the opportunities for creative research in paleontology been better. Never has the talent been of higher caliber. And never has the opportunity for constructive evaluation of our profession been more timely or more appropriate.

I therefore present a proposal to you. It is time for census and consensus.

As for census, I strongly urge support of efforts now under way by the Joint Committee on Paleontologic Information to find out who we are, how many we are, what interest groups and paleontological organizations we belong to, and where we are employed. Incidentally, this would provide some checks on the CEGS survey by bringing it up to date and extending the sample through the entire profession.

As for consensus, I think that a similar broad survey should be made into the nature, status, and opportunities of the paleontological profession. This would be timely because it would coincide with the start of the environmental decade. But it also now seems to be justified in view of the grave deficiencies and irrationalities that emerged as a result of the partial survey upon which the CEGS report is based.

We should think back over the history of the profession in order to specify and evaluate the stimuli which led to its growth. We should examine the present state of the profession and try to elucidate its positive and negative aspects. The general scientific fields of interest in which paleontologists can carry on rewarding research and provide useful services need to be outlined. Our personal financial obligation to support societies and journals needs to be completely revamped and placed on a realistic footing. Frankly, it is ridiculous to try to administer a high level professional society in the hand to mouth fashion in which The Paleontological Society operates. Our individual commitment is more appropriate to that of students in school clubs than of members in a professional international society. The relationships between the various organizations both profesional and amateur need to be restudied and somehow restructured so that we can achieve whatever ends we desire with economy and efficiency. Increased effectiveness might be achieved through fusion of some societies, but it might also be achieved by creation of a super-group such as a Paleontologists' Association.

So far I have spoken in generalities, but some important concrete suggestions come to mind for research and service by paleontologists. These are not sophisticated avant-garde suggestions, but some of them should enhance employment opportunities for more paleontologists. As for research, the field of paleogeographic distribution has been considered so casually that we are, or ought to be, embarrassed at the moment because there is no treatise, compendium, system of check lists, or even bibliography on the subject. Structural geologists currently are busy exploring exciting paleogeographic concepts involving the motions of continents and sea floors, but the paleontologic data, which would be so helpful in the discussions, are badly scattered and disorganized, except for that on some of the microfossils. The result is that we are contributing only a modicum of evidence at this time when we should be able to recognize and delineate the paleontologic faunal realms with considerable confidence.

Another neglected field is that of illustrated faunal associations. It is true that journal papers commonly list and illustrate the species in a formation, but we rarely see a major work any more in which the common fossils of a large geographic region or of a geologic province are illustrated. The very useful and remarkable Treatise of Invertebrate Paleontology is now well advanced, but non-specialists are likely to have trouble identifying a random specimen from that work. Possibly we have arrived at a time when a similar major encyclopedia on faunal associations would be appropriate and useful. Illustrated indices have been started on more than one occasion, but none has progressed far enough up to now to be even remotely as useful for any order of megafossils as is the Ellis and Messina catalogue of foraminif-

ers. At least two benefits would be derived from the availability of a catalogue. First, and simplest, it would facilitate identification, preparations, and curating of material not only by professionals but by skilled amateurs. More and more people are collecting fossils—indeed, there is a growing fear that fossil localities are being exhausted almost as soon as their existence is published. Under the circumstances, anything that will enhance the number and value of collections is a step in the right direction. In this regard, reference collections are almost certainly going to become extremely useful in the future as localities become exhausted.

Second, although the general public seems not to be able or willing to grasp the significance of our growing shortage of mineral resources, this is obviously going to be one of the great crises linked with the population explosion, spiraling energy demands, and conservation of materials. Paleontologists could hardly be wrong in preparing now to provide the most significant service they can for the intense exploration activity that is sure to come within the next decade or two. Applied paleontology therefore can become an occupation of greatly increased usefulness and will offer opportunities for many new positions to properly trained personnel. Some geological surveys such as the USGS have always provided excellent consultative service to their field geologists through their active Paleontology and Stratigraphy Branch; and at the same time the paleontologists carry forward active research programs. Oil companies, of course, also have utilized paleontology extensively in the past. Recently, the AAPG has predicted that much of the new reserve of fossil fuels that this country will need will have to be found using techniques not now being applied. This view may well apply to the search for other mineral resources. If paleontology is to have as important a part as possible in the coming exploration boom, then it is likely that we will have to perfect the developing techniques of quantification in refined description and identification of materials, in population studies for correlations, and in environmental interpretations of sedimentary facies. An illustrated faunal index would be of inestimable value to those who will need ready access to information in order to perfect applied paleontology in the near future.

But the most pressing need revealed by the CEGS report is for a major review of the education of paleontologists. Curricula should be examined and proposals generated for the most desirable possible education of professional geologists.

It generally happens that college curricula contain a core of courses which are judged to be of such importance that all major students in a department should enroll in them. Historically, this means that students have been trained primarily as physical geologists and only incidentally as paleontologists. A common solution has been to defer much paleontological work into graduate school, and this may be the correct procedure. In any case, it almost certainly has contributed to the large number of doctoral degrees granted in paleontology. Meanwhile, more and more requirements of basic physical science and mathematics are being added to core curricula while some earth science, and in particular, biological science and paleontology, are being reduced or dropped from undergraduate programs. In other cases the emphasis on course content is being shifted to accommodate desirable ends such as stressing ecology and environment, even though adequate background has not been provided for these studies.

Several possible curricula could be suggested which would be suitable for persons either specializing in paleontology or desiring to use it as an adjunct to other branches of earth science. Under the most fortunate circumstances, future paleontologists ought to feel that they are more adequately trained than paleontologists seem to indicate that they are at present. Furthermore, revised curricula ought to provide training which would enable our colleagues in the other earth sciences to recognize the strengths and methodology of paleontology more clearly than they do at present. Along this line, the CEGS report seems to indicate in several branches of earth science that we may be entering an age wherein only the results of a service discipline are desired and that the reasoning and understanding behind them will be left to specialists. If this be the case, then our responsibilities will be increased to serve those uncritical branches with the utmost sensitivity and competence. But if we in turn produce uncritical specialists within our own branch, due to educational shortcomings, then our profession will suffer.

Evidence is accumulating that the field of education will continue to be a major source of employment of paleontologists in the future, but perhaps not in quite the same patterns as at present. For one thing, our large youthful group will move up in rank and responsibility, eventually becoming a large knot of old hands dominating this field. It will take about 30 years for the bulge to be reduced, and in the meantime we may see a more evenly spaced influx of new faces. It is also possible that not only paleontologists but all sorts of post-graduate specialists

will very likely find it necessary to seek employment in educational institutions preparatory to colleges and universities. Even if this second factor does not come to pass, we should be generating suggestions as to how paleontology courses might serve needs of general education down through secondary and even into primary grades. At its most elementary level paleontology is a highly suitable vehicle to introduce students to the scientific method and for them to begin learning what science is all about. One of our greatest failures today in science education is that people have come to feel awe and fear of science, but not to have much understanding. If we can structure our materials so that we help to produce a citizenry capable of making well-founded decisions in general, then they may also judge intelligently the role of science and the need to support it. This may be our greatest contribution and success.

I do not mean to imply that we should try to dictate curricula (which probably is not possible anyway), but that we should try to show what kinds of knowledge seem to be appropriate at different levels. Then, if paleontologists in a particular department wish to strengthen their curriculum along patterns of their own design, they could support their requests with recommendations of profession-wide extent, originated by this society.

As for a program of action, I suggest a two-stage approach. At first the society should empower a small group selected on a regional basis to sound out opinion as to whether or not a major professional review and projection of the profession such as I have been suggesting should be undertaken.

Assuming that this preliminary report is favorable, then your Council could authorize a full-scale investigation. The work should be supported by a grant from an appropriate agency or foundation and there should be a salaried director of the project to ensure its guidance, continued progress and completion. Existing committees and societies can provide much of the needed information, but naturally the entire profession should be solicited and queried for information and suggestions. Special task forces are essentially in existence now through the various "Friends of the —" groups. Ultimately we should have a definitive report on the history and present state of the profession, its constituency, and the probable worthwhile courses of action in planning for the future. It is likely that the formal investigation would require two years to complete.

The substance of this address is being presented to the Council of The Paleontological Society. If they approve the initial step, you may soon have a voice in shaping not only your own future, but the future of paleontology in this country, and perhaps the future functions of this society.

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